

What is claimed is:

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1. A multi-wavelength surface emitting laser for emitting light having a first wavelength and light having a second wavelength, the laser comprising:

a substrate;

5 a first surface emitting laser which emits light having a first wavelength, directly formed on a portion of an upper surface of the substrate and including,

a first lower reflector formed of two alternately deposited semiconductor material layers having a same type of impurity, but different refractive indices;

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a first active layer; and

a first upper reflector formed of two deposited semiconductor material layers having different refractive indices and an opposite type of impurity to that of the first lower reflector;

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a second surface emitting laser which emits light having a second wavelength, directly formed on a portion of an upper surface of the substrate neighboring the first surface emitting laser and including;

a second lower reflector formed of two alternately deposited semiconductor material layers having different refractive indices and a same type of impurity;

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a second active layer; and

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~~a second upper reflector formed of two deposited semiconductor material layers having different refractive indices and an opposite type of impurity to that of the second lower reflector;~~
~~a lower electrode layer;~~
~~a first upper electrode formed on the first upper reflector, which electric power is applied to; and~~
~~a second upper electrode formed on the second upper reflector, which electric power is applied to.~~

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2. ~~The laser as claimed in claim 1, further comprising a first high resistance portion partially formed in the first upper reflector, which limits a flow of current; and~~
~~a second high resistance portion partially formed in the second upper reflector, which limits a flow of current.~~

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3. A method for manufacturing a multi-wavelength surface emitting laser comprising the steps of:

forming a first surface emitting laser which emits light having a first wavelength, the forming of the first surface emitting laser including,

5 depositing, sequentially, on a prepared substrate a first lower reflector, a first active layer and a first upper reflector, the first lower reflector formed by;

10 depositing, alternately, two semiconductor material layers having a same type of impurity, but different refractive indices, the first upper reflector formed by;

depositing, alternately, two semiconductor material layers having an opposite type of impurity to that of the first lower reflector and having different refractive indices;

15 partially removing the first upper reflector, the first active layer, and the first lower reflection layer by etching; and

forming a protection film on an outer surface of the first surface emitting laser;

forming a second surface emitting laser which emits light having a second wavelength, the forming of the second surface emitting laser including,

20 depositing, sequentially, on the substrate and the protection film, a second lower reflector, a second active layer, and a second upper reflector, the second lower reflector formed by;

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25 depositing, alternately two semiconductor material layers having a same type of impurity, but different refractive indices, the second upper reflector formed by;

depositing, alternately, two semiconductor material layers having an opposite type of impurity to that of the second lower reflector and different refractive indices;

30 removing portions of the second lower reflector, the second active layer, and the second upper reflection layer formed on the protection film by etching; and

removing the protection film;

forming a first upper electrode on an upper surface of the first upper reflection layer;

35 forming a second upper electrode on an upper surface of the second upper reflection layer; and

forming a lower electrode on a bottom surface of the substrate.

4. The method as claimed in claim 3, wherein the protection film is formed of one selected from a group consisting of silicon nitride and silicon oxide.

5. The method as claimed in claim 3, further comprising a step of forming first and second high resistance portions by injecting protons into part of the first and second upper reflectors before the first and second upper electrodes are formed.

6. A multi-wavelength surface emitting laser for emitting light having a first wavelength and light having a second wavelength, the laser comprising:
a substrate;
a first surface emitting laser which emits light having a first wavelength formed on a portion of the substrate; and
a second surface emitting laser which emits light having a second wavelength formed on a portion of the substrate.

7. The laser as claimed in claim 6, wherein the first surface emitting laser includes,
a first lower reflector;
a first active layer; and
a first upper reflector, and wherein the second surface emitting laser includes,
a second lower reflector;
a second active layer; and
a second upper reflector.

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8. The laser as claimed in claim 7, wherein the first lower reflector is formed of two alternately deposited semiconductor material layers having a same type of impurity, but different refractive indices, and the first upper reflector is formed of two deposited semiconductor material layers having
5 different refractive indices and an opposite type of impurity to that of the first lower reflector, and

wherein the second surface emitting laser is formed of two alternately deposited semiconductor material layers having different refractive indices and a same type of impurity, and the second upper reflector is formed of two
10 deposited semiconductor material layers having different refractive indices and an opposite type of impurity to that of the second lower reflector.

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9. The laser as claimed in claim 7, further including:
a lower electrode;
a first upper electrode formed on the first upper reflector, which electric power is applied to; and
5 a second upper electrode formed on the second upper reflector, which electric power is applied to.

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10. The laser as claimed in claim 6, wherein the first surface emitting laser and the second surface emitting laser are formed on an upper surface of the substrate, and wherein the first surface emitting laser and the second surface emitting laser neighbor each other.

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11. A method for manufacturing a multi-wavelength surface emitting laser comprising the steps of:

forming a first surface emitting laser which emits light having a first wavelength, on a substrate; and

5 forming a second surface emitting laser which emits light having a second wavelength on the substrate.

12. The method as claimed in claim 11, wherein the first surface emitting laser is formed by,

5 depositing, sequentially, on the substrate a first lower reflector, a first active layer and a first upper reflector, and wherein the second surface emitting laser is formed by;

forming a protection film on an outer surface of the first surface emitting laser; and

depositing, sequentially, on the substrate and the protection film, a second lower reflector, a second active layer, and a second upper reflector.

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13. The method as claimed in claim 12, wherein the first lower reflector is formed by,

depositing, alternately, two semiconductor material layers having a same type of impurity, but different refractive indices, and wherein the first upper reflector is formed by;

depositing, alternately, two semiconductor material layers having an opposite type of impurity to that of the first lower reflector and having different refractive indices, and wherein the second lower reflector is formed by;

depositing, alternately two semiconductor material layers having a same type of impurity, but different refractive indices, and wherein the second upper reflector formed by;

depositing, alternately, two semiconductor material layers having an opposite type of impurity to that of the second lower reflector and different refractive indices.

14. The method as claimed in claim 12, further including, removing portions of the second lower reflector, the second active layer, and the second upper reflection layer formed on the protection film by etching; and

removing the protection film.

15. The method as claimed in claim 14, further including;

forming a first upper electrode on an upper surface of the first upper reflection layer;

forming a second upper electrode on an upper surface of the second upper reflection layer; and

forming a lower electrode on a bottom surface of the substrate.

16. A multi-wavelength surface emitting laser for emitting light having a first wavelength and light having a second wavelength, the laser comprising:

a substrate;

first laser emitting means for emitting a laser having a first wavelength; and

second laser emitting means for emitting a laser having a second wavelength.

17. The laser as claimed in claim 16, wherein the first surface emitting laser includes,

first laser reflecting means; and

first energy transition means for generating a laser beam, and

wherein the second surface emitting laser includes,

second laser reflecting means; and

second energy transition means for generating a laser beam.

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18. The laser as claimed in claim 16, further including
lower electrode means;
first upper electrode means for accepting electric power; and
second upper electrode means for accepting electric power.

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